

**REMARKS**

Reconsideration and allowance of the subject application in view of the foregoing amendments and the following remarks is respectfully requested. Claims 1-4, 6-8, 10-14, 16-17, and 20 are pending in the application, of which claims 17 and 20 are withdrawn from consideration by the Examiner as being directed to a non-elected invention. By this amendment, claims 1, 8, 10-12, 14, and 16 are amended. This Amendment should be entered under Rule 116 because it places this application in condition for allowance.

**Restriction Under 35 U.S.C 121**

The restriction is traversed for the reason that the subject matter of all species is sufficiently related that a thorough search for the subject matter of any one species would encompass a search for the subject matter of the remaining species. Specifically claims 1-4, 6, 8, 10-14, and 16 are drawn to a method of optimizing an interpreter-based run time system using a virtual machine. Claims 17 and 20 are drawn to a method of optimizing the performance of an application running on an interpreter-based runtime system. Applicants respectfully submit that notwithstanding the assertions of the Examiner, the amendments to claims 1 and 17, made in the response filed August 29, 2007, are not such that explicitly direct the claims to distinct inventions.

Notwithstanding Applicants' submission that the amendments fail to significantly amend the claims so as to require restriction, Applicants' further submit that the claims are such that the search and examination of the entire application could be made without serious burden. See MPEP §803 in which it is stated that "if the search and examination of an entire application can be made without serious burden, the examiner must examine it on the merits, even though it includes claims to independent or distinct inventions" (emphasis added). It is respectfully submitted that this policy should apply in the present application in order to avoid unnecessary delay and expense to Applicants and duplicative examination by the Patent and Trademark Office (PTO).

**Rejections under 35 U.S.C. 102**

Claims 1-4, 6, 8, 10-14, and 16 stand rejected under 35 USC §102(b) as being anticipated by U.S. Patent 6,865,734 to Holzle et al. ("Holzle"). These rejections are respectfully traversed. A rejection based on 35 U.S.C. §102 requires every element of the claim to be included in the reference, either directly or inherently. Applicants respectfully submit that Holzle fails to disclose all features of the amended claims.

A common thread to the arguments presented below is that the Applicants' claimed method is drawn to an interpreter-based runtime system that a) deduces semantically rich opcodes to replace strings of existing code in an application; b) optimizes the semantically rich opcodes and generates interpreter action codes for these new opcodes; and c) imbeds the semantically enriched opcodes into the application's bytecodes and builds a virtual machine that includes the interpreter action codes for the new opcodes in order to decode the embedded target application in the runtime environment. Holzle, on the other hand only appears to disclose a method that is particularly suitable "for use in computer systems that are arranged to execute both interpreted and compiled byte codes." (Emphasis added)(see column 2, lines 28-32). Indeed, the method of Holzle appears to be drawn to a method that interprets a portion of an application's bytecodes and compiling selected ports bytecodes to optimize the runtime execution, and nowhere disclose optimizing that portion of the bytecodes to be interpreted, rather than compiled.

**Claim 1 is Patentable Under 35 USC 102(b) Over Holzle**

Specifically, as amended, claim 1 recites, *inter alia*, a method of optimizing the performance of an interpreter-based runtime system, comprising:

1) "[A]ugmenting the bytecode set of the virtual machine with application-specific opcodes, thereby constituting an application domain-specific virtual machine." Although the Office Action asserts that Holzle, (e.g., Fig. 1, compiled byte codes 152, compiled frequently executed code 162, column 4, line 2 to column 5, line 20), discloses this feature, Applicants respectfully disagree. Fig. 1 of Holzle and the cited passage appears to only disclose wherein "byte codes 144 may be processed with an interpreter 148. Alternatively, byte codes 144 may be compiled by a compiler 150 to produce compiled byte codes 152." Holzle further discloses wherein a measure is kept as to how many times a method is interpreted and when the number of times a method is

interpreted exceeds a threshold, the method may be compiled using compiler 150. Nowhere does Holzle disclose, teach, or suggest augmenting the bytecode set of the virtual machine with application-specific opcodes, as recited in amended claim 1.

Accordingly, Applicants respectfully submit that the Applicants' claimed method that augments bytecodes that are to be interpreted by "an interpreter-based runtime system" is distinguished from the method of Holzle that selectively compiles byte codes.

2. "[O]ptimizing the virtual machine based on semantics of the application to be run on the virtual machine." Although the Office Action asserts that Holzle, (e.g., Fig. 3, column 7, line 24 to column 9, line 65), discloses this feature, Applicants respectfully disagree. At the cited passage, Holzle appears to only disclose selective compilation of methods to optimize the execution of a specific application. Applicants respectfully submit that the method of Holzle is distinguished from the Applicants' method of optimizing the virtual machine itself, rather than just the optimization of an application executed by the virtual machine, as disclosed by Holzle.

3. "[P]erforming a quantitative trade-off between time and space to determine effective semantically enriched opcode and encoding the semantically enriched opcode into interpreter action code based upon the trade-off." Although the Office Action asserts that Holzle, (e.g., column 1, line 55 to column 2, line 22, and column 4, line 43 to column 5, line 20), discloses this feature, Applicants respectfully disagree. At the cited passage, Holzle appears to only disclose "compiling" selected methods, and nowhere discloses, teaches or suggests determining semantically enriched opcodes that are to be interpreted, and further fails to disclose encoding interpreter action code to be used by interpreter 644 rather than compiler 642.

4) "[A]nalyzing frequently executed bytecodes and encoding the semantically enriched opcodes of the into interpreter action codes of the instruction set of the virtual machine to efficiently interpret frequently executed bytecodes." Although the Office Action asserts that Holzle, (e.g., Fig. 6, column 11, line 28 to column 12, line 38), discloses this feature, Applicants respectfully disagree. At the cited passage, Holzle appears to only disclose wherein "compiling" selected methods is an alternative to "interpreter action codes" every bytecode, and nowhere discloses, teaches or suggests developing "interpreter action codes" to be used by interpreter 644.

5) "[S]tatically embedding the semantically enriched opcode to optimize execution of the

*interpreter-based runtime system that includes runtime system on the application domain-specific virtual machine.*" As presented above, Holzle appears to only disclose combining compiled code with bytecode, and nowhere discloses, teaches or suggests embedding semantically enriched opcodes, as opposed to compiled code, to optimize execution of a interpreter-based runtime system, as recited in claim 1.

Accordingly, as presented above Holzle fails to disclose at least these features of claim 1.

Claim 11 is Patentable under 35 USC 102(b) over Holzle

Regarding claim 11, the PTO asserts that Holzle disclose:

*"[a] method of generating an embedded virtual machine for a specific domain of an application, comprising the step of:*

*embedding semantically enriched code in an interpreter loop of the virtual machine to efficiently decode frequently executed code."* (Emphasis added).

Applicants respectfully disagree and submit, as presented above, that Holzle only appears to disclose "compiling" selective portions of bytecodes rather than interpreting all byte codes, and fails to disclose embedding semantically enriched code into an interpreter loop, as recited in claim 11. that recites

Based upon the above arguments, Applicants respectfully submit that Holzle fails to disclose at least these features of independent claims 1 and 11. Accordingly, claims 1 and 11 are allowable over Holzle. Claims 2-4, 6, 8, 10, 12-14, and 16 depend variously from independent claims 1 and 11 and are likewise patentable over Holzle at least for their dependence an allowable base claim, as well as for additional features they recite. Withdrawal of the rejection over Holzle is respectfully requested.

Claim 11 is Patentable Under 35 USC 102(e) Over Bertis

Claim 11 is further rejected under 35 USC §102(e) as being anticipated by U.S. Patent 6,631,515 to Bertis. Specifically, the Examiner asserts that Bertis, at column 7, lines 16-24;

column 5, lines 33-67; column 2, lines 19-41; column 5, lines 22-31; and column 8, lines 14-40, discloses the features of claim 11. This rejection is respectfully traversed. Similar to Holzle, Bertis appears to only disclose "precompiling" selected bytecode paths into "native machine code" and delivering to a client "[c]lass files 410 [that] contain both bytecodes and optimized content, such as native machine code." (Emphasis added). As argued above, native machine code is compiled code, and as such is distinguished from optimized bytecodes comprising semantically enriched codes for embedding into an interpretive loop of a virtual machine, as recited in claim 11.

Applicants respectfully submit, therefore, that Bertis similarly fails to disclose the features of independent claim 11. Accordingly, claim 11 is likewise allowable over Bertis. Claim 12 depends from independent claim 11 and is likewise patentable over Bertis at least for its dependence on an allowable base claim, as well as for additional features it recites. Withdrawal of the rejection over Bertis is respectfully requested.

#### **Rejections under 35 U.S.C. 103(a)**

Claim 1 is further rejected under 35 USC §103(a) as being unpatentable over Bertis in view of U.S. Patent 6,014,519 to Egashira. This rejection is respectfully traversed because the asserted combination of references do not teach or suggest all of Applicants' claim limitations.

The PTO asserts that Bertis discloses all features of claim 1 except for:

*"performing a quantitative trade-off between time and space to determine effective semantically enriched opcode and encoding the semantically enriched opcode into interpreter action code based upon the trade-off."*

The Examiner relies upon Egashira to remedy this deficiency of Bertis. Applicants respectfully submit however that Bertis, in a manner similar to Holzle, appears only to disclose compiling portions of bytecodes and including these compiled portions with portions that remain to be interpreted. Similar to Holzle, nowhere does Bertis disclose embedding semantically enriched opcode that is to be interpreted by a run-time interpreter, the interpreter being optimized to recognize the embedded opcodes. Notwithstanding any disclosure of Egashira regarding

“performing a quantitative trade-off ...,” applicants respectfully submit that Egashira fails to remedy the deficiencies of Bertis, in respect to the other features of claim 1.

Therefore, Applicants respectfully submit that the asserted combination of references fails to disclose the method of optimizing the performance of an interpreter-based runtime engine, as recited in claim 1. Accordingly, withdrawal of this rejection is respectfully requested.

### **Conclusion**

All objections and rejections having been addressed, it is respectfully submitted that the application is in condition for allowance and a Notice to that effect is earnestly solicited.

Entry of the amendments is proper under 37 CFR §1.116 since the amendments: (a) place the application in condition for allowance for the reasons discussed herein; (b) do not raise any new issue requiring further search and/or consideration since the amendments amplify issues previously discussed throughout prosecution; and (c) place the application in better form for appeal, should an appeal be necessary. The amendments are necessary and were not earlier presented because they are made in response to arguments raised in the final rejection. Entry of the amendments is thus respectfully requested.

The Examiner is invited to telephone the undersigned, Applicant's attorney of record, to facilitate advancement of the present application.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 08-2025 and please credit any excess fees to such deposit account.

Respectfully submitted,

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